Welcome to CUGR country

Joan Michel discusses the Chemical Biological Radiation Nuclear Unmanned Ground Vehicle (CUGR)

Today's battlefield looks far different from that of even ten years ago. Military equipment designed for open spaces and traditional weaponry doesn't meet the requirements brought on by today's predominantly urban warfare environment. Now, warfighters need to be able to operate in small spaces, from safe distances, at high speeds, and with increased protection against a greater variety of threats.

Focussed on the threat

Edgewood Chemical Biological Center (ECBC) engineers and researchers are looking for ways for today's warfighters to conduct chemical, biological, radiological, and nuclear reconnaissance faster and safer. This work is being done under the Chemical Biological Radiation Nuclear Unmanned Ground Vehicle Advanced Concepts Technology Demonstration program (CUGR ACTD), which has two primary goals – first, to improve and quicken detection of surface contamination, and second to increase warfighters' ability to recon areas with limited access using a robotic platform.

Current recon systems use a Double Wheel Sampling System (DWSS) and a Chemical-Biological Mass Spectrometer to detect surface contamination. The logistical problems have been that vehicles must pass slowly over a potentially contaminated area, disrupting operational tempo, and surface conditions can interfere with successful detection of contamination. Also, multiple areas of contamination are difficult to discriminate and the mechanical nature of the DWSS increases operational risk to the warfighter.

The CUGR will employ a non-surface contacting technology called UV Raman Surface Detection, which will speed up detection times by allowing vehicles to conduct surface detection at speeds up to 45 miles per hour. Raman surface detection uses molecular light scattering phenomena to selectively detect the presence of chemical agents by way of spectral fingerprinting. Substances have unique Raman signatures resulting from differences in their chemical structures; for example, clear plastic has a distinct signature that is very different from the signature of asphalt, or any other

"Hello Kitty": say hello to CUGR © ECBC

substance. Chemical agents have a unique signature as well, and this signature can provide a way to remotely detect and identify the presence of agent. Devices utilising Raman spectroscopy are able to assess liquids, gases, solids and aerosols, are not distracted by water in either liquid or vapor form, and enjoy negligible variations in signatures or signal strength regardless of surface texture or reflectivity.

The Joint Service Contaminated Surface Detector (JSCSD), which will be incorporated into the CUGR, applies Raman spectroscopy to short-range standoff detection. The JSCSD uses a laser to illuminate a surface contaminated with agent. The light is reflected by the agent back to the JSCSD where the pattern is received, separated, analysed, and processed into a chemical fingerprint, and compared against a database of known Raman signatures, which ECBC is developing in partnership with the private sector. The results of this comparison will identify the agent. This technology will be installed in traditional military vehicles, including the Joint

Service Lightweight NBC Reconnaissance System (JSLNBCRS) HMMWV variant.

Scientists have been studying UV Raman Surface Detection technology for more than 20 years, but efforts to deploy the technology have been thwarted by the size and power requirements to operate this technology in the field. Now that power sources are getting smaller and stronger, Raman is a viable alternative to other detection technologies currently in use by the military and civilian communities.

From caves to the city

In the other thrust area of the CUGR ACTD, ECBC scientists and engineers are looking to extend warfighters' reach to conduct CBRN reconnaissance in buildings, tunnels, caves and other areas where a vehicle cannot go or where you do not want to send a warfighter. This involves adding a remote detection capability to the recon vehicle by including a small-unmanned ground vehicle (UGV) and integrating NBC and Toxic Industrial Chemical sensors into various sensor payload modules

that plug and play into an UGV platform. Warfighters will be able to tailor the UGV to specific mission profiles by selecting from various sensor modules. The UGV will also be capable of collecting biological and chemical samples for further analysis. The UGV will be remotely operated from an NBC recon vehicle, or the control unit can be dismounted from the recon vehicle and the robot can be controlled by the warfighter in the field. Miniaturising and balancing the standard detection equipment to fit on an UGV presents the engineering challenge ECBC is addressing.

Detection on the move

Because industry has already invested extensive research and development into many technologies for detection and identification of chemical warfare agents, toxic industrial chemicals and biological agents, for the UGV ECBC will be utilising existing mature commercial off the shelf (COTS) and non-developmental items backed up by independent test data verifying vendor

claims. These technologies need to employ Raman spectroscopy for "on-the-move" chemical solid and liquid contamination detection and photo ionisation and Ion Mobility Spectrometry for chemical detectors. Proven and emerging technologies are also being considered for biological collection.

Proven technologies include a dry filter collection device and emerging technologies include Next Generation Sensor (NGS) Technology and a micro UV airborne biological detection system. The CUGR ACTD is on track for technical and operational testing in FY 2006. ECBC recently completed its market survey and trade-off-analysis and initiated purchases for the robot and for chemical warfare agent, toxic industrial chemical, and gamma radiation detectors. The iRobot PackBot was selected as the UGV for the CUGR ACTD.

In the future, work that results from the CUGR ACTD may be integrated into both the JSLNBCRS LAV variant and Stryker NBC Reconnaissance Vehicle. ECBC expects the

CUGR ACTD will also enhance the capabilities of the Future Combat System UGV program, through demonstration of the NBC operational missions not currently available. Additionally, the NBC payload modules for the UGV may be adopted for use in the Man Transportable Robotic System managed by PM Explosive Ordnance Disposal. The resultant JCSD and CUGR systems will address the acquisition goals of the Joint Program Executive Office Chemical Biological Defense and the Program Executive Office Ground Combat Systems.

The U.S. Army Edgewood Chemical Biological Center is the lead Department of Defense laboratory for non-medical chemical and biological defense. ECBC provides detection, protection and decontamination systems to combat chemical and biological warfare agents to warfighters in all branches of the US military. It also leverages its knowledge and infrastructure via technology transfer partnerships with federal, state and local agencies as well as private sector entities. **NBCI**

ROVs are becoming more prevalent in NBC © NBC International